

Laboratory Support to New Hampshire Department of Environmental Services: PFAS Contamination near Industrial Use Sites

Oct.4, 2018

Summary

At the request of the New Hampshire Department of Environmental Services (NH DES), EPA scientists are conducting independent laboratory analyses of samples collected by NH DES and others to characterize per- and polyfluoroalkyl substances (PFAS) present in areas of concern near industrial sources in southern New Hampshire. EPA is analyzing surface water, groundwater and soil samples collected near the manufacturing facilities, as well as coating products used by the facilities. EPA is also analyzing air emissions samples from process exhaust towers and char samples of exhaust ducts that were collected from an industrial source.

In a recent analysis, EPA scientists used targeted analysis laboratory methods to identify and measure concentrations of PFAS in water samples collected from an industry-impacted area in New Hampshire. EPA scientists also used targeted and non-targeted laboratory methods to analyze air emissions samples collected from an industrial site of concern. On Oct 4, 2018, EPA shared a report of their analyses with NH DES for their review and use.

Twenty-five blind ground and surface water samples were analyzed by EPA for the presence of PFAS. Eleven PFAS chemicals were measured in the samples. EPA's measurements of the chemicals in the water samples confirm prior measurements made by the state of New Hampshire. Most of the samples had measurable concentrations of one or more PFAS, and many had concentrations of multiple chemicals. Perfluorooctanoic Acid (PFOA) was consistently present at the highest concentration across the 25 samples. Pefluorooctane Sulfonate (PFOS) and Perfluorobutane Sulfonate (PFBS) were observed in multiple samples. GenX was found to be above the limit of detection in one sample. Concentrations of other PFAS varied by sample and ranged from less than the limit of detection to 2,200 nanograms per liter.

Air samples collected from ambient air at an industrial site, and from multiple process exhaust tower stacks (including at the intake and exhaust of an emissions control device from one process tower) were analyzed by EPA scientists using both targeted and non-targeted laboratory analysis methods. This analysis will provide information to NH DES on the effectiveness of the emission control technology recently tested at the facility. EPA scientists used a non-targeted lab method to tentatively identify 12 PFAS chemicals in the air samples. Chemical concentrations were not quantified in this analysis. EPA scientists additionally used [[HYPERLINK "https://www.epa.gov/homeland-security-research/epa-air-method-toxic-organics-15-15-determination-volatile-organic"](https://www.epa.gov/homeland-security-research/epa-air-method-toxic-organics-15-15-determination-volatile-organic)], a targeted laboratory method, to identify and approximate levels of volatile organic compounds present in plant emissions. This method is not an EPA regulatory compliance method for stationary sources of hazardous air pollutants.

Background and Results

The water samples were collected by NH DES on September 27, 2017. Air process emissions samples for the non-targeted laboratory analysis were collected by NH DES; and air samples for the targeted laboratory analysis were collected by a contractor to the industrial facility. All air samples were collected between April 26, 2018 and May 1, 2018.

The PFAS chemicals measured by EPA in the targeted laboratory analysis of the water samples using Liquid Chromatography Mass Spectrometry are:

- Perfluoro(2-methyl-3-oxahexanoic) acid (GenX)
- Perfluorobutanoic acid (PFBA)
- Perfluoropentanoic acid (PFPeA)
- Perfluorohexanoic acid (PFHxA)
- Perfluoroheptanoic acid (PFHpA)
- Perfluorooctanoic acid (PFOA)
- Perfluorononanoic acid (PFNA)
- Perfluorodecanoic acid (PFDA)
- Perfluorobutane Sulfonate (PFBS)
- Perfluorohexane Sulfonate (PFHxS)
- Perfluorooctane Sulfonate (PFOS)

Twelve PFAS chemicals were tentatively identified in the whole air emissions samples using Chemical Ionization Mass Spectrometry (CIMS), a non-targeted laboratory analysis method. This method is limited in its detection of polar PFAS such as telomer alcohols or carboxylic acids. It provides the likely chemical formula, however, the exact isomer or arrangement of atoms within the PFAS cannot be ascertained. The likely chemicals represented by their formula are given below.

- $C_3FH_5O_2$
- $C_5F_3H_9O_3$
- $C_6F_2H_6O_2$
- $C_6F_9H_5O$
- $C_7F_6H_{10}O_2$
- $C_7F_{11}H_5O$
- $C_7F_{13}H_3O$
- $C_8F_7H_5O_4$
- $C_{811}H_7O_2$
- $C_8F_{13}H_5O$
- $C_9FH_7O_2$
- $C_{10}F_{13}H_9O_2$

The chemicals identified in air emission stack samples using [[HYPERLINK
"https://www.epa.gov/homeland-security-research/epa-air-method-toxic-organics-15-15-determination-volatile-organic"](https://www.epa.gov/homeland-security-research/epa-air-method-toxic-organics-15-15-determination-volatile-organic)], a targeted laboratory method, are:

- Propylene
- Propane
- Dichlorodifluoromethane
- Chloromethane
- Isobutane
- 1-Butene
- 1,3-Butadiene
- Butane
- Ethanol
- Acetonitrile
- Acolein
- Acetone
- iso-Pentane
- Isopropyl Alcohol
- 1-Pentene
- n-Pentane
- Isoprene
- trans-2-butene
- Acrylonitrile
- trans-2-pentene
- cis-2-pentene
- Tert-Butanol
- Carbon Disulfide
- Vinyl Acetate
- 2-Butanone
- 1-Hexene
- Tetrahydrofuran
- 2,4-Dimethylpentane
- Benzene
- Cyclohexane
- 4-Methy-2-Pentanone
- Cyclopentane
- 3-Methylpentane
- Diisopropyl ether
- n-Hexane
- 2-Methylhexane
- 3-methylhexane
- 1,4-Dioxane
- Isooctane

- Heptane
- Toluene
- Methylcyclohexane
- Octane
- m-Xylene
- Nonane
- Undecane
- Naphthalene
- 2-Methylheptane
- Dodecane

Non-targeted analysis involves analyzing water, soil, air and other types of samples to identify unknown chemicals that may be present, without having a preconceived idea of what chemicals may be in the samples. With targeted analysis, researchers first identify what they are looking for, and then they test for it.

Non-targeted analysis is useful considering targeted methods are geared toward a relatively small number (15-20) of the PFAS representing a small fraction of chemicals that make up this class of chemicals, which is believed to number around 3,000.

EPA is using a combination of targeted and non-targeted analysis methods to evaluate PFAS in environmental samples.

In an analysis conducted for NH DES in spring 2018, EPA scientists used targeted laboratory methods to measure concentrations of perfluorocarboxylates in soil and char samples. Types of perfluorocarboxylates measured in the spring 2018 targeted analysis of soil and char samples are:

- Perfluorobutanoic acid (PFBA)
- Perfluoropentanoic acid (PFPeA)
- Perfluorohexanoic acid (PFHxA)
- Perfluoroheptanoic acid (PFHpA)
- Perfluorooctanoic acid (PFOA)
- Perfluorononanoic acid (PFNA)
- Perfluorodecanoic acid (PFDA)
- Perfluoroundecanoic acid (PFUnDA)
- Perfluorododecanoic acid (PFDoDA)
- Perfluorotridecanoic acid (PFTrDA)
- Perfluorotetradecanoic acid (PFTeDA)
- Perfluorohexadecanoic acid (PFHxDA)
- Perfluorooctadecanoic acid (PFOcDA)

In an analysis conducted for NH DES in July 2018, EPA scientists used non-targeted laboratory methods to measure concentrations of per- and polyfluoroalkyl substances (PFAS) in soil and

char samples. Two novel PFAS were identified in this analysis: a hydrogenated polyfluorinated carboxylic acid series (HPFCA) that included 15 different chemicals and a hydrogenated polyfluorinated sulfonic acid series (HPFSA) that included 15 chemicals.

The novel PFAS carboxylic acid series identified in the July 2018 non-targeted analysis of soil and char samples are:

- Hydro-polyfluorohexanoic acid (HPFHxA)
- Hydro-polyfluoroheptanoic acid (HPFHpA)
- Hydro-polyfluorooctanoic acid (HPFOA)
- Hydro-polyfluorononanoic acid (HPFNA)
- Hydro-polyfluorodecanoic acid (HPFDA)
- Hydro-polyfluoroundecanoic acid (HPFUA)
- Hydro-polyfluorododecanoic acid (HPFDoA)
- Hydro-polyfluorotridecanoic acid (HPFTrA)
- Hydro-polyfluorotetradecanoic acid (HPFTeA)
- Hydro-polyfluoropentadecanoic acid (HPFPDA)
- Hydro-polyfluorohexadecanoic acid (HPFHxDA)
- Hydro-polyfluoroheptadecanoic acid (HPFHpDA)
- Hydro-polyfluorooctadecanoic acid (HPFODA)
- Hydro-polyfluorononadecanoic acid (HPFNDA)
- Hydro-polyfluoroicosanoic acid (HPFIA)

The novel PFAS sulfonic acid series identified in the July 2018 non-targeted analysis of soil and char samples are:

- Hydro-polyfluorobutanesulfonate (HPFBS)
- Hydro-polyfluoropentanesulfonate (HPFPS)
- Hydro-polyfluorohexanesulfonate (HPFHxS)
- Hydro-polyfluoroheptanesulfonate (HPFHpS)
- Hydro-polyfluorooctanesulfonate (HPFOS)
- Hydro-polyfluorononanesulfonate (HPFNS)
- Hydro-polyfluorodecanesulfonate (HPFDS)
- Hydro-polyfluoroundecanesulfonate (HPFUS)
- Hydro-polyfluorododecanesulfonate (HPFDoS)
- Hydro-polyfluorotridecanesulfonate (HPFTrS)
- Hydro-polyfluorotetradecanesulfonate (HPFTeS)
- Hydro-polyfluoropentadecanesulfonate (HPFPDS)
- Hydro-polyfluorohexadecanesulfonate (HPFHxDS)
- Hydro-polyfluoroheptadecanesulfonate (HPFHpDS)
- Hydro-polyfluorooctadecanesulfonate (HPFODS)

EPA is working closely with states, tribes, local communities and other stakeholders to build on the steps the agency has already taken to develop additional toxicity values, analytical methods and treatment options for PFAS in drinking water.

Information about the NH DES PFAS investigation can be found on their website: [HYPERLINK
"https://www4.des.state.nh.us/nh-pfas-investigation/" \t "_blank"]

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